Spruce

White spruce, *Picea glauca*
Black spruce, *Picea mariana*

The **volume of spruce has increased** significantly since 1983. The number of seedlings has doubled in the last ten years suggesting that, unless mortality increases significantly, the spruce resource will remain stable in the future.

Mortality rates, however, **are higher than average**. Whereas spruce makes up about 2% of volume and growth of trees in Wisconsin, it accounts for 2.7% of total mortality.

Spruce is **not an important timber species**, accounting for only 1% of roundwood product and 1.7% of woody biomass. It is a low density wood and may not be good for biofuel production.

- *How has the spruce resource changed?*
  Growing stock volume and diameter class distribution: 1983, 1996, and 2012
- *Where is the spruce resource in the state?*
  Growing stock volume by region with map
- *How fast is spruce growing?*
  Average annual net growth by region and year: 1983, 1996, and 2012
- *How healthy is spruce in Wisconsin?*
  Average annual mortality: 1983, 1996, and 2012
- *How much spruce do we harvest?*
  Roundwood production by product and year: 1997, 2003, and 2009
- *How much is spruce selling for?*
  Prices for cordwood and sawtimber: 2000 to present
- *How much spruce biomass do we have?*
  Aboveground carbon by region of the state: 2012

"How has the spruce resource changed?"

Growing stock volume and diameter class distribution by year

The growing stock volume of spruce in Wisconsin in 2012 was approximately 460 million cft or about 2.1% of total statewide volume (Chart 1). This represents an increase of 41% since 1983 and 15% since 1996.

The spruce resource is maturing. Volume in all size classes has increased but especially in larger trees (Chart 2). For instance, the volume in small trees (5 to 13 inches) has increased 32% since 1983 but the volume in large trees (over 13 inches) has doubled in the same period.

The number of saplings has increased by 22% in the last 15 years (Chart 3), suggesting that spruce will remain a vital component of our forests in the future.

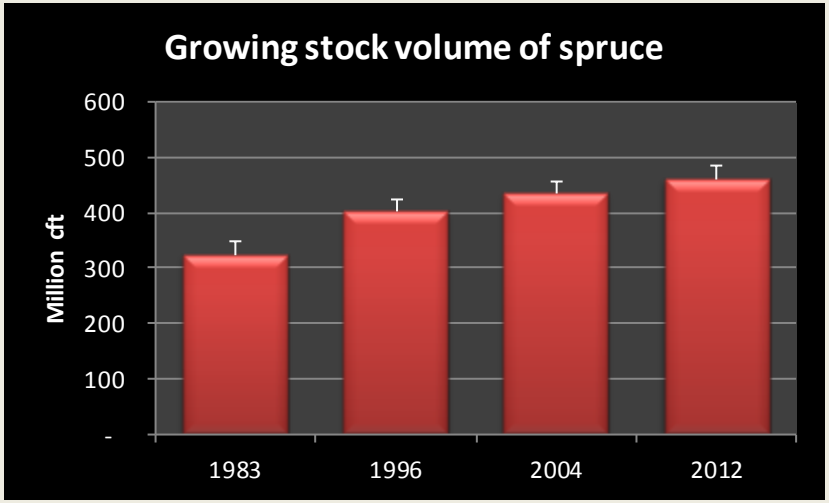


Chart 1. Growing stock volume (million cubic feet) by inventory year.
Source: USDA Forest Inventory and Analysis data: 1983, 1996, and 2012.

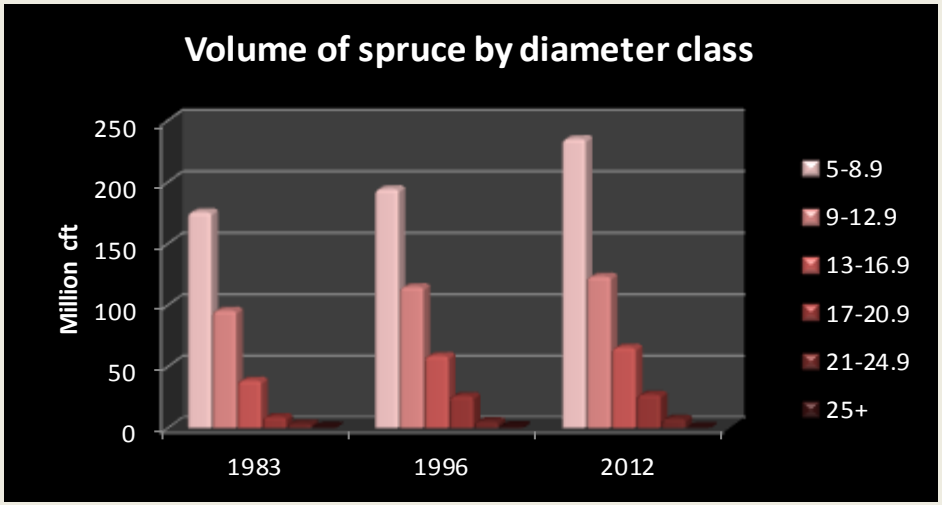


Chart 2. Growing stock volume (million cubic feet) in 1983, 1996, and 2012.
Source: USDA Forest Inventory and Analysis data: 1983, 1996, and 2012.

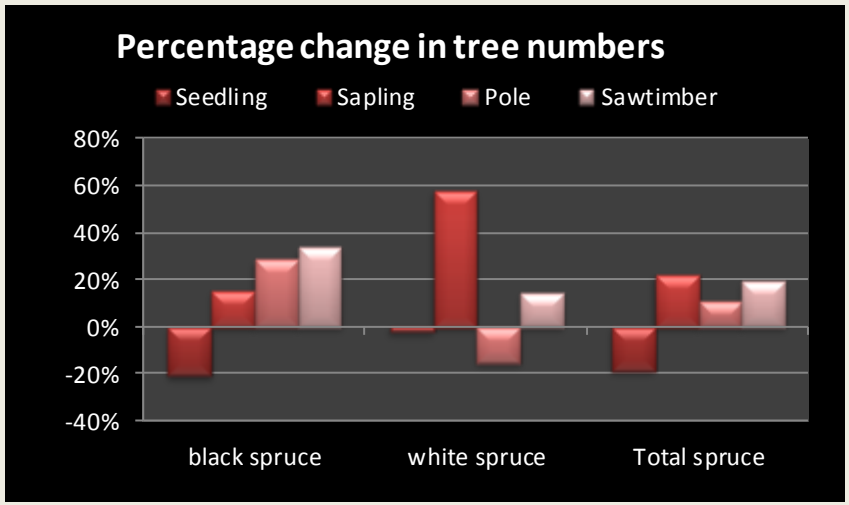
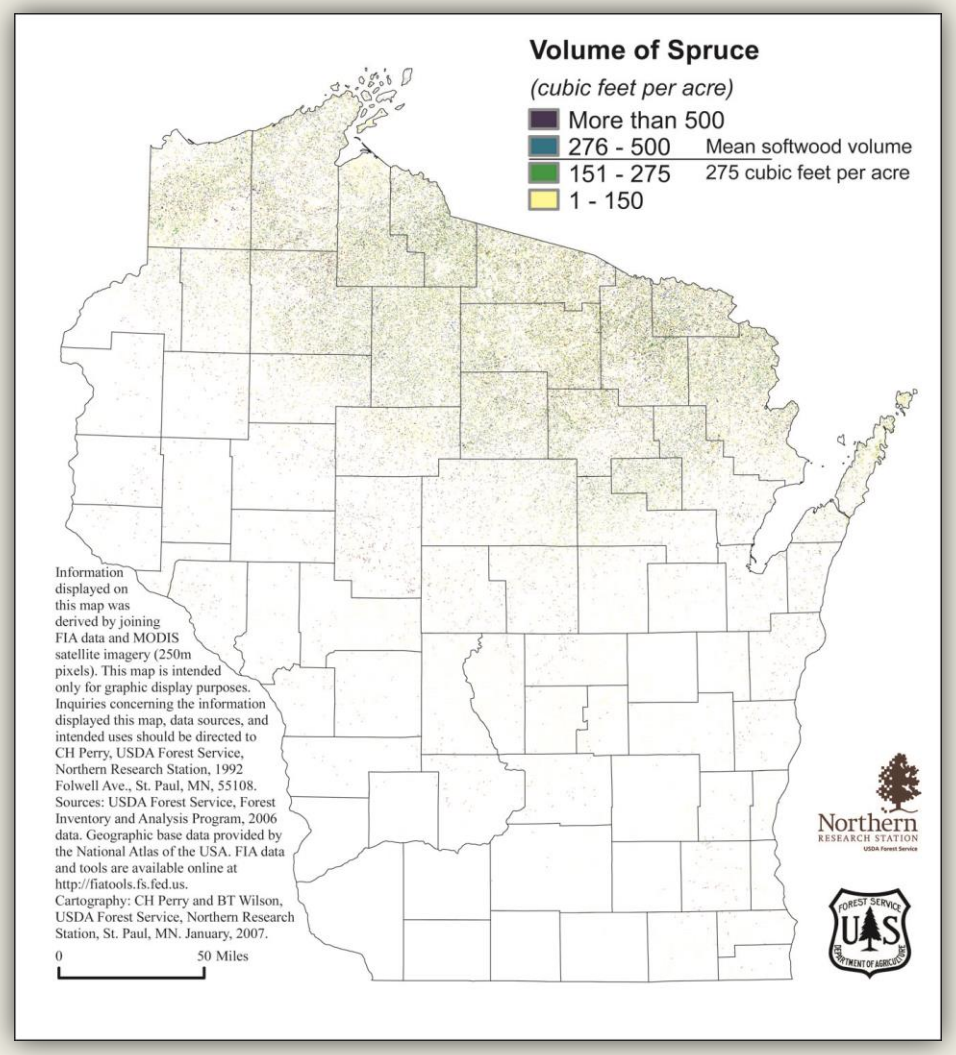


Chart 3. Percentage change in the number of live trees by size class between 1996 and 2012.
Source: USDA Forest Inventory and Analysis data 1996, and 2012.

"Where does spruce grow in Wisconsin?"

Growing stock volume by region with map



The vast majority of white and black spruce occurs in northern Wisconsin (Table 1). White spruce is found on a variety of soil and moisture conditions whereas black spruce occurs predominately in wet, low-nutrient soils.

Most spruce is found on the spruce fir forest type but in central and northern Wisconsin, about one quarter is found on the aspen birch type.

Table 1. Growing stock volume (million cft) by species and region of the state.

Species	Central	North east	North west	South east	South west	Total	Percent of total
Black Spruce	4	122	78	0	-	205	**45%**
White Spruce	18	101	105	18	13	255	**55%**
Total spruce	22	224	183	19	13	460	**100%**
Percent of total	**5%**	**49%**	**40%**	**4%**	**3%**	**100%**	

Source: USDA Forest Service, Forest Inventory and Analysis 2012 data

For a table on **Volume by County for 2012** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/VolumeCountySpecies.pdf

"How fast is spruce growing?"

Average annual net growth by region and year

Average annual net growth of spruce is about 11.2 million cft/yr, representing 2% of statewide volume growth (Chart 4). Growth rates have decreased 32% since 1983.

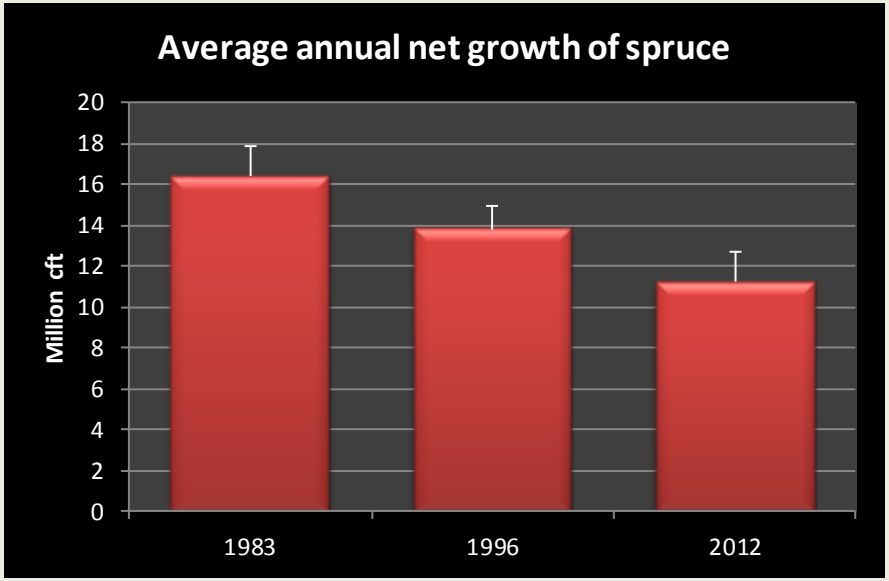


Chart 4. Average annual net growth (million cubic feet).
Source: USDA Forest Inventory & Analysis data: 1983, 1996, 2012

Table 2. Average annual net growth (million cft/year) of growing stock and the ratio of growth to volume by region of the state.

Region	Net growth	Percent of Total	Ratio of growth to volume
Central	1.3	11%	**5.8%**
Northeast	5.3	48%	**2.4%**
Northwest	2.2	20%	**1.2%**
Southeast	1.6	14%	**8.6%**
Southwest	0.8	7%	**6.0%**
Statewide	**11.2**	**100%**	**2.4%**

Source: USDA Forest Inventory and Analysis 2012

The highest volume growth for spruce occurs in northern Wisconsin where most spruce is found, but the highest growth to volume ratio occurs in the southern part of the state (Table 2).

The average statewide ratio for spruce is 2.4%, lower than the statewide average of 2.6% for all species.

For a table of **Average annual growth, mortality and removals by region** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf

"How healthy is spruce in Wisconsin?"

Average annual mortality: 1983, 1996, and 2012

Average annual mortality of spruce, about 6.9 million cft per year from 2008 to 2012, or about 2.9% of total statewide mortality (Chart 5). Mortality has more than quadrupled since 1983 and increased 50% since 1996.

The ratio of mortality to gross growth is 38% for spruce, **higher than the statewide average** of 28.8% (Table 3).

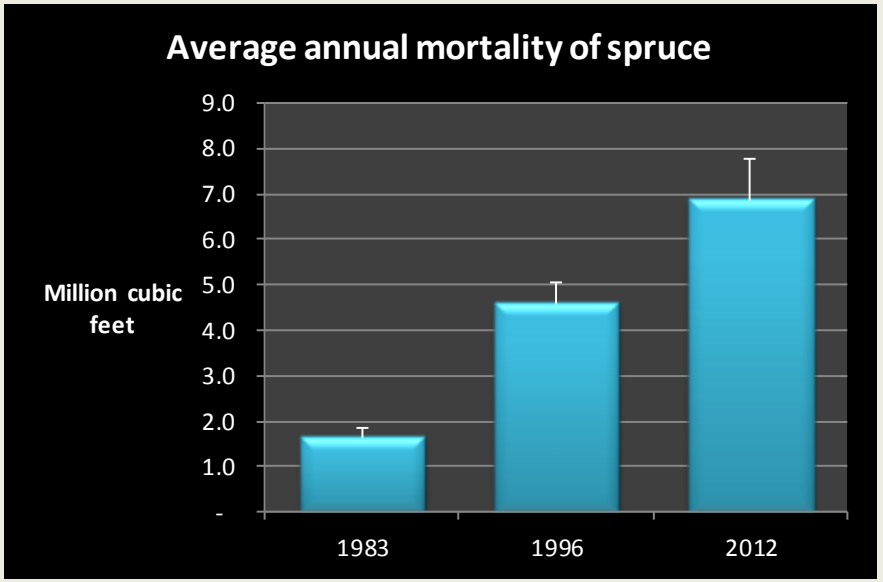


Chart 5. Average annual mortality (million cubic feet) by inventory year.
Source: USDA Forest Inventory & Analysis data: 1983, 1996, and 2012

Table 3. Mortality, gross growth (excluding mortality) and the ratio of mortality to gross growth.

Species	Average annual mortality (cft)	Average annual gross growth (cft)	Mortality / growth
Black Spruce	2,604,688	7,441,453	**35.0%**
White Spruce	4,259,351	10,608,519	**40.2%**
Total Spruce	6,864,039	18,049,972	**38.0%**

Source: USDA Forest Inventory and Analysis 2010

For a table of **Average annual growth, mortality and removals by region** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf

"How much spruce do we harvest?"

Roundwood production by product and year: 1997, 2002 and 2008

In 2009, spruce accounted for 7.9 million cft or about 2.2% of Wisconsin's total roundwood production. This was an increase of 27% since 2003 (Chart 6).

From 2003 to 2009, pulpwood production increased by 40%. Spruce supplies 7 million cft or 4.1% of total pulpwood production.

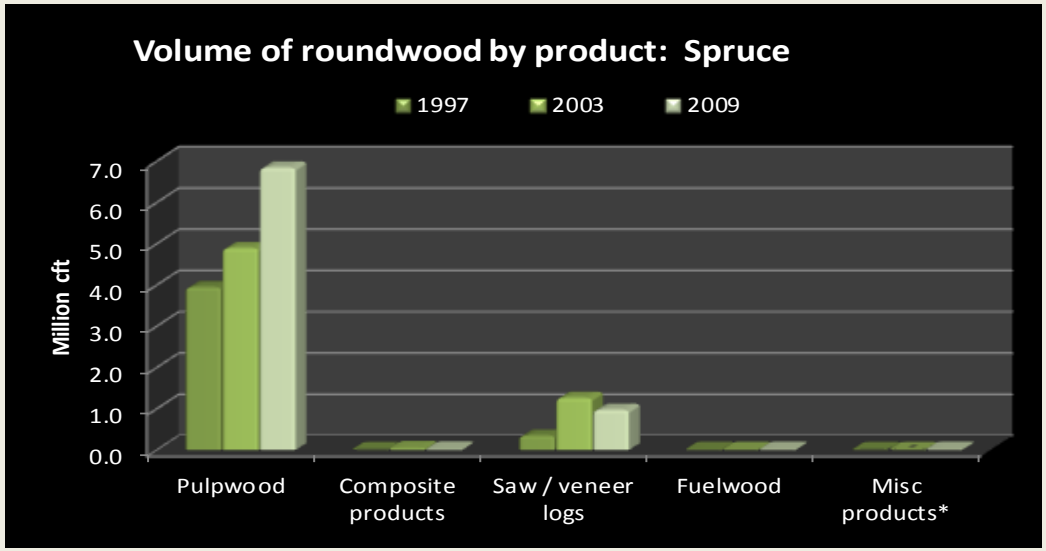


Chart 6. Volume of roundwood products. * Miscellaneous products include poles, posts, and pilings.
Source: Ronald Piva, USDA Forest Service, Northern Research Station, St. Paul MN

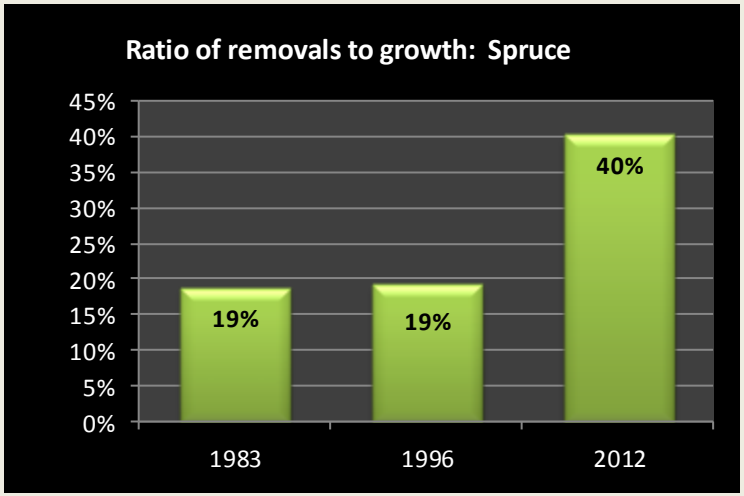


Chart 7. Ratio of volume harvested annually to net growth.
Source: USDA Forest Inventory & Analysis data: 1983, 1996, and 2012.

Removals of spruce were 4.5 million cft from 2008 to 2012, 90% of which was white spruce.

The ratio of removals to growth for spruce is 40.2%, lower than the average of 53.4% for all species in the state (Chart 7).

For a table of **Average annual growth, mortality and removals by region** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf

"How much is spruce selling for?"

Prices for cordwood & sawtimber: 2000 to present

Due to the variability of timber prices from region to region, the prices reported here are the average weighted average stumpage prices from Wisconsin Administrative Code Chapter NR46.

Stumpage prices for spruce have decreased for the last 7 years and are currently below average for softwoods.

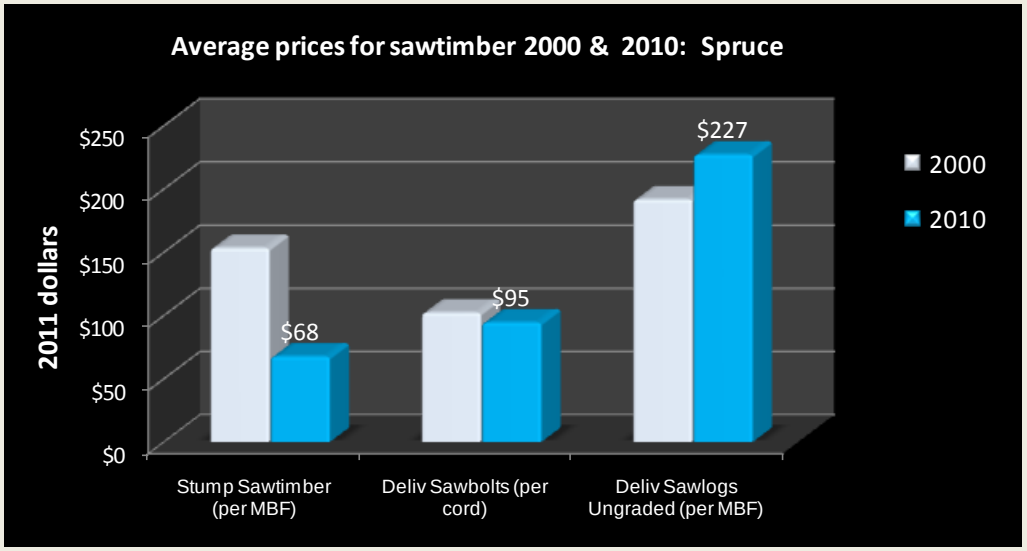


Chart 8. Average prices for cordwood and sawtimber (2000-2010).
Source: Wisconsin Administrative Code Chapter NR46 (2000-2010)

Table 4. Average weighted stumpage prices (adjusted for inflation to 2010 dollar) by year for Wisconsin.

Product	2002	2003	2004	2005	2006	2007	2008	2009	2010	2012	Average for all softwoods
Cordwood (per cord)	$40	$49	$47	$56	$49	$40	$27	$27	$26	**$24**	$30
Sawlogs (per MBF)	$123	$139	$64	$116	$139	$85	$86	$72	$72	**$89**	$103

Source: Wisconsin Administrative Code Chapter NR46, 2002 to 2012. The stumpage values calculated each year are for the sole purpose of assessing MFL yield and FCL severance taxes, not for determining the price that should be received for timber.

"How much spruce biomass do we have?"

Aboveground carbon by region of the state

There were 10.8 million short tons of aboveground biomass in live spruce trees in 2012, an increase of 38% from 1983. This is equivalent to approximately 5.4 million tons of carbon and represents 1.7% of all aboveground biomass statewide. As with volume, most spruce is located in northern Wisconsin (Chart 9).

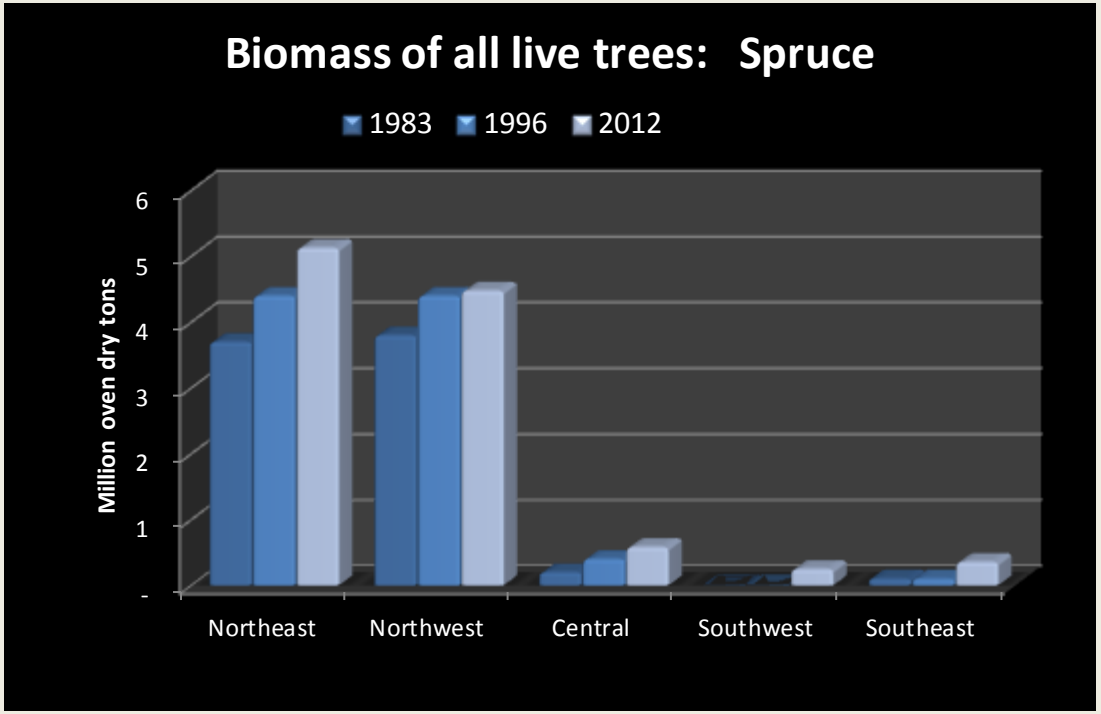


Chart 9. Biomass (above ground dry weight of live trees >1 in dbh, short tons) by year and region of the state.
Source: USDA Forest Inventory & Analysis data: 1983, 1996, and 2012

The density of spruce wood is slightly lower than average for softwoods with a ratio of biomass to volume of 33.8 oven-dry lbs. per cubic foot (ODP/cft). The average for all softwoods is about 34.3 ODP/cft and for all species is 46.8 ODP/cft.

Approximately, 80% of all spruce biomass is located in the main stem and 14% in the branches.

For a table of **Biomass by County for 2012** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/BiomassByCounty.pdf